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DEPARTMENT OF DEFENSE

ELECTROMAGNETIC COMPATIBILITY ANALYSIS CENTER

A GLOSSARY OF ELECTROMAGNETIC COMPATIBILITY (EMC) TERMS

Edited by H. E. Winter of the
IIT Research Institute

August 1973

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Technical Report

No. ESD-TR-73-024

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**DEPARTMENT OF DEFENSE
Electromagnetic Compatibility Analysis Center**

**Edited by H. E. Winter
of the IIT Research Institute**

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FOREWORD

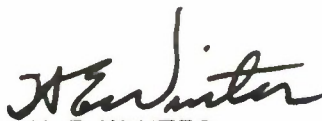
The Electromagnetic Compatibility Analysis Center (ECAC) is a Department of Defense facility, established to provide advice and assistance on electromagnetic compatibility matters to the Secretary of Defense, the Joint Chiefs of Staff, the military departments and other DOD components. The Center, located at North Severn, Annapolis, Maryland 21402, is under executive control of the Assistant Secretary of Defense for Telecommunications and the Chairman, Joint Chiefs of Staff, or their designees, who jointly provide policy guidance, assign projects, and establish priorities. ECAC functions under the direction of the Secretary of the Air Force and the management and technical direction of the Center are provided by military and civil service personnel. The technical operations function is provided through an Air Force sponsored contract with the IIT Research Institute (IITRI).

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To the extent possible, all abbreviations and symbols used in this report are taken from American Standard Y10.19 (1967) "Units Used in Electrical Science and Electrical Engineering" issued by the United States of America Standards Institute.

Users of this report are invited to submit comments which would be useful in revising or adding to this material to the Director, ECAC, North Severn, Annapolis, Maryland 21402, Attention ACL.

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ABSTRACT

This document contains definitions of terms and certain acronyms that are related to the subject of electromagnetic compatibility.

KEYWORDS

**ELECTROMAGNETIC COMPATIBILITY
GLOSSARY**

EMC GLOSSARY

INTRODUCTION

This glossary defines terms and certain acronyms that are related to the subject of electromagnetic compatibility (EMC). It is not intended to be an all-inclusive dictionary of electronic terms. Rather, it is limited to terms likely to be encountered in treating the electromagnetic compatibility aspects of the broader field of electronics. Some of the definitions are couched in terms which relate to the way words are used within the EMC field. One of the purposes of this glossary is to serve as a terminology standard for use by report writers of the Electromagnetic Compatibility Analysis Center.

The definitions herein have been obtained from a variety of sources, including Sarbachers's *Encyclopedic Dictionary of Electronic and Nuclear Engineering*, Skolnik's *Radar Handbook*, Air Force Manual 100-39 *Communications-Electronics Terminology*, Department of Defense standards and publications, and IEEE* and EIA documents. Some of the definitions represent the consensus opinion of cognizant engineers and scientists who are engaged in the field of electromagnetic compatibility.

The existence of this glossary should eliminate the need for some glossaries in the future and reduce the length of others.

* Definitions that are in word-for-word agreement with the IEEE Standard Dictionary of Electrical and Electronic Terms (IEEE Std 100-72) have been identified with "(IEEE-72)".

A

ABSORPTION

The irreversible conversion of the energy of an electromagnetic wave into another form of energy (e.g., heat) as a result of its interaction with matter. (IEEE-72)

ACSC-E

Department of the Army Assistant Chief of Staff for Communications-Electronics (responsible for Army EMC program).

ADJACENT SIGNAL

A signal whose fundamental frequency falls outside the 3 dB IF bandpass of a receiver, but whose spectral sidebands have the potential of being linearly transferred into the baseband of a receiver and causing interference.

AFC

1. Automatic Frequency Control.
2. Area Frequency Coordinator. Examples are the Western Area Frequency Coordinator (WAFC) and the Eastern Area Frequency Coordinator (EAFC).

AFSC

Air Force Systems Command.

AFWL

Air Force Weapons Laboratory.

AGC

Automatic Gain Control.

AJ (Anti-Jamming)

1. The art of minimizing the effects of enemy electronic countermeasures so that the purpose of the system (i.e., radar, communications, beacon, etc.) can be fulfilled in spite of the presence of jamming.
2. Controls or circuit features incorporated to minimize jamming.

ALGORITHM

A prescribed set of well-defined rules or processes for the solution of a problem in a finite number of steps; for example, a full statement of an arithmetic procedure for evaluating $\sin x$ to a stated precision. (IEEE-72)

AM (Amplitude Modulation)

The process by which the amplitude of a carrier frequency is varied at a rate corresponding to the frequency of the information carried.

ANALOG

Pertaining to the representation of data by means of continuously variable physical quantities; e.g., shaft position (rotation), voltage, resistance. Contrasts with digital representation techniques.

ANOMALY, Propagation

A change in propagation characteristics due to a discontinuity or abnormality in the medium of propagation.

ANSI

American National Standards Institute.

ANTENNA

A structure used for radiating or receiving electromagnetic energy.

ANTENNA PATTERN

A representation, usually in the form of a polar or rectangular plotted graph, of the radiated field intensity of an antenna. Common practice is to measure the field intensity patterns in the three orthogonal planes; however, other measuring techniques, such as conical cuts, are often used.

APERTURE (Antenna)

A surface, near or on an antenna, on which it is convenient to make assumptions regarding the field values for the purpose of computing fields at external points. *Notes:* (1) In some cases the aperture may be considered as a line. (2) In the case of a unidirectional (high gain) antenna, the aperture is often taken as that portion of a plane surface near the antenna, perpendicular to the direction of maximum radiation, through which the major part of the radiation passes. (See EFFECTIVE APERTURE and MAXIMUM EFFECTIVE APERTURE). (IEEE-72)

APERTURE ILLUMINATION

The field distribution, in amplitude and phase, over the antenna physical aperture. Also, the phase and amplitude of the element feed voltages, or the distribution of the currents, in an array of elements.

ARRAY

1. An assembly of radiating elements with spacing and illumination sequence such that the radiated fields from the individual elements combine to produce a maximum field intensity in a particular direction and minimum field intensities in other directions.
2. A multi-dimensional arrangement of information for storage in a computer data bank.

ARTICULATION INDEX (AI)

A measure of voice system intelligibility based on a division of the speech spectrum into contiguous frequency bands. The intensity of speech varies according to frequency. The speech energy levels in the contiguous bands are summed, and the sum can be used with empirical curves to determine a corresponding articulation score.

ARTICULATION SCORE (AS)

A subjective measure of the intelligibility of a voice system in terms of the percentage of words correctly understood over a channel perturbed by interference. Articulation scores have been experimentally obtained as functions of varying word content, bandwidth, audio signal-to-noise ratio and the experience of the talkers and listeners involved.

ASD

The Aeronautical Systems Division of the Air Force Systems Command.

ASD(T)

The Assistant Secretary of Defense for Telecommunications. The incumbent is one member of a two-member board of directors for the Department of Defense Electromagnetic Compatibility Program. [See JCS(J-6).]

ATMOSPHERICS

Disturbances in reception caused by natural electric discharge, such as the electromagnetic energy radiated from a static lightning discharge.

ATTENUATION

The decrease in the energy of a signal as the result of transmission between points in a medium, usually expressed in decibels (dB), or dB per unit length.

AUTHORIZED CARRIER FREQUENCY

A specific carrier authorized for use, from which the actual carrier frequency is permitted to deviate, solely because of frequency instability, by an amount not to exceed a given frequency tolerance.

AUTOCORRELATOR

A detection device in which the input signal is delayed, then multiplied by the undelayed signal. The product is then averaged (smoothed) in a low-pass filter. An autocorrelator can be used to detect a weak periodic signal in the presence of noise if the chosen time delay is equal to the period of the signal.

AVERAGE POWER

The power averaged over a time interval that is long compared with the period of the lowest frequency encountered in the modulation.

AZIMUTH ANGLE

The azimuth of an object is the angle, centered on an observer and measured clockwise in a horizontal plane, between true north and the vertical plane containing the object.

B

BACK LOBE

The energy radiated from a directional antenna in a direction opposite to the axis of the main lobe.

BACK SCATTER

The reflection of radiated energy from an object or an atmospheric layer back toward the illuminating radar.

BANDPASS FILTER

A device that provides rejection to signals that are either higher than its upper frequency limit or lower than its lower limit. Signals at frequencies between the upper and lower limits are not attenuated significantly.

BANDWIDTH

The difference, in hertz, between the limiting frequencies of a frequency band.

BANDWIDTH, IF

The spread in frequency between the half-power points on a receiver IF response curve.

BANDWIDTH, Necessary

For a given class of emission, the minimum value of the occupied bandwidth sufficient to ensure the transmission of information at the rate and with the quality required for the system employed, under specified conditions. Emissions useful for the good functioning of the receiving equipment, such as the emission corresponding to the carrier of reduced carrier systems, shall be included.

BANDWIDTH, Occupied

The frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5% of the total mean power radiated by a given emission.

BANDWIDTH, RF

The spread in frequency between the half-power points on a receiver RF response curve.

BASEBAND

The range of frequencies necessary to contain the modulation of the intelligence in a radio signal.

BAUD

A unit of signaling speed derived from the duration of the shortest code element. By extension, the speed in bauds is the number of code elements per second.

BEACON

A device which serves as a signal emitter for use as a guidance or warning aid. Radar beacons aid the radar set in locating and identifying special targets which may be difficult or impossible to sense otherwise.

BEAMWIDTH

The width of an antenna beam, in degrees or mils, measured at the 3 dB (half power) points.

BEARING (Navigational)

The angle, in degrees, measured clockwise in the horizontal plane from a reference. True bearings are referenced to true north. Relative bearings are referenced to the longitudinal axis of an aircraft or a ship.

BEARING RATE

The rate at which bearing changes with respect to time, as a result of relative motion between an observation point and a target.

BINARY

The characteristic or property involving a selection, choice, or condition in which there are only two possibilities, i.e., on or off, 1 or 0, up or down, etc.

BINARY DIGIT

A whole number in the binary system of notation; its "value" is either a zero (0) or one (1). It may represent on or off, yes or no, or one of the choices in any other two-choice situation.

BIT

A contraction of BINARY DIGIT.

BIT RATE

In the transmission of data, the number, per unit of time, of binary digits (or pulses representing them) which pass a given point in a continuous stream. Usually expressed in bits per second.

BLANKING

A technique for reduction of pulsed interference whereby a receiver is turned off for the duration of each undesired pulse.

BONDING

The process of obtaining a high degree of electrical conductivity between metallic parts.

BORESIGHT

The physical axis of a directional antenna. Boresighting is the term for the initial alignment of a directional antenna, using either an optical procedure or a fixed target at a known location.

BOUND (of a function)

A curve that encloses the major peaks of the envelope of a function. An example is the Mason-Zimmerman curve which bounds the spectrum associated with a time waveform.

BURNOUT

In a receiver, burnout refers to the reception of so much power that component damage occurs. (See HIGH POWER EFFECTS.)

C

CARRIER

A deliberate electromagnetic emission that carries intelligence through a modulation of one or more of its characteristics.

CASSEGRAIN ANTENNA

An antenna used to achieve a highly directive, pencil beam emission with a plane wave front. It consists of a paraboloidal primary reflector and a hyperboloidal secondary reflector. The secondary reflector is situated between the vertex and the focal point of the primary reflector so that one of the foci of the secondary reflector coincides with the focal point of the primary reflector. The feed system is situated at the other focus of the secondary reflector.

CCIR

The International Radio Consultative Committee of the International Telecommunications Union.

C-E

Communications-Electronics.

CEEIA

Communications-Electronics Engineering Installation Agency, Ft. Huachuca, Arizona.

CHAFF

Strips of cut metal foil, wire, or metal bars which may be dropped from an aircraft or a missile or expelled from shells or rockets as a means of passive radar deception through confusion reflection. The lengths of the metal elements may be random, in which case some energy will be reflected over a wide range of frequencies, or they all may be cut the same length, in which case only a narrow band of energy will be reflected.

C/N

Carrier-to-noise ratio. Synonymous with signal-to-noise ratio (See Signal-To-Noise Ratio).

CNM

The Chief of Naval Material.

CNO

The Chief of Naval Operations.

COBOL

A coding system designed to facilitate the digital programming of business-oriented problems. From "COmmon Business-Oriented Language".

CO-CHANNEL

Occupying the same portion of the frequency spectrum. An emission is considered to be co-channel with a receiver if its center frequency is within the 3 dB IF bandwidth of the receiver.

COMPANDOR (also COMPANDER)

A combination of a compressor at one point in a communication path for reducing the volume range of signals, followed by an expander at another point for restoring the original volume range. Usually its purpose is to improve the ratio of the signal to any interference that may enter the system at a point in the path between the compressor and the expander.

COMPATIBILITY

(See ELECTROMAGNETIC COMPATIBILITY).

CONVERSION

The process of transferring a carrier and its modulation sidebands from one frequency to another. Normally accomplished in a mixer or converter stage.

COSITE

Refers to collocation. On the same vehicle, station or base. (Equipment so located is often subject to interference because of its proximity to other equipment).

COUPLER, Antenna

A network or device used to match a transmitter and/or receiver to an antenna.

COUPLING

The opposite of isolation. The amount of coupling is a measure of the energy transfer between units or systems (normally via antennas in EMC work).

CRITICAL FREQUENCY

In propagation work, the highest frequency at which radio energy will be reflected by an ionospheric layer rather than penetrate through it.

CROSS-CORRELATOR

A detection device in which a received signal is multiplied by a locally generated reference signal and the product is averaged (smoothed) in a low-pass filter. It can be used for detecting weak signals in noise in cases where the important signal characteristics are known prior to detection.

CROSS MODULATION

The modulating of a desired signal carrier by undesired signal modulation as the result of accidental mixing of the two signals in a non-linear device.

CROSS POLARIZATION

The polarization orthogonal to a reference polarization component. (IEEE-72)

CULL

The application of general criteria and pessimistic thresholds to eliminate the majority of interference possibilities from further consideration in an EMC analysis.

CUT OFF FREQUENCY (WAVEGUIDE)

That frequency below which electromagnetic energy will not propagate in a waveguide.

D

DA

Department of the Army.

DATA BASE (EMC)

Data files on environmental electronics equipment, including locations, frequencies, technical characteristics, terrain data and regulatory information.

dB (decibel)

A dimensionless unit equal to ten times the logarithm (to the base 10) of the ratio of two power levels. If P_1 and P_2 are two power levels and n is the number of decibels denoting the ratio, then $n = 10 \log_{10} (P_1/P_2)$ dB. Power also can be expressed in terms of the square of the current or the square of voltage. If the impedance remains unchanged, the decibel relationship can also be expressed as:

$$n \text{ (dB)} = 20 \log_{10} (I_1/I_2)$$

$$n \text{ (dB)} = 20 \log_{10} (V_1/V_2) .$$

dBaO

In microwave and common carrier systems, a measure of the noise power with reference to zero dBm at the Reference (zero) Transmission Level Point. Noise power (dBa), measured at any transmission level point, can be expressed in dBaO by correcting the measurement for the difference in level between the point of measurement and the Reference Transmission Level Point.

dB_i

A unit of antenna gain. The number of decibels referenced to the zero dB directivity of a free space isotropic radiator.

dBm

The number of decibels referenced to one milliwatt.

dBmO

In microwave and common carrier systems, a measure of power with reference to zero dBm at the Reference Transmission Level Point. Power (dBm), measured at any transmission level point, can be expressed in dBmO by correcting the measurement for the difference in level between the point of measurement and the Reference Transmission Level Point.

dBmOp

In microwave and common carrier systems, circuit noise power measured with an instrument having psophometric weighting. (Psophometric — from the Greek psophos, meaning noise. Psophometric weighting is related to the interference effect of a 3-kHz band of white noise with a power of -88 dBm.)

dBW

The number of decibels referenced to one watt.

DCA

Defense Communications Agency.

DDR&E

Director of Defense Research and Engineering.

DEAD TIME

In radar, the interval following a pulse transmission during which the receiver is unable to respond to an incoming signal.

DECADE

A ten to one relationship, particularly of frequencies. If f is a given frequency, then the decade steps are $10f$, $100f$, $1000f$, —, etc. Frequently used to describe the rate of fall off of the amount of energy in a pulse, i.e., "the slope of the pulse envelope is 40 dB per decade".

DECM

Defensive Electronic Countermeasures.

DECODER

An electronic device which compares the time characteristics of a pulse train with a desired time sequence, passing signals which compare well and rejecting those which do not. Essentially, a decoder extracts intelligence from a coded signal.

DEGRADATION

A decrease in the quality of a desired signal as the result of interference, noise or distortion.

DEMODULATION

The process of recovering the intelligence signal from the carrier signal on which it was superimposed (See DETECTOR).

DESENSITIZATION

The reduction of desired signal gain as the result of receiver reaction to an undesired signal. The gain reduction is generally due to overload of some portion of the receiver (e.g., the AGC circuitry), resulting in desired signal suppression because the receiver will no longer respond linearly to incremental changes in input voltage.

DETECTOR (also called DEMODULATOR)

The stage or circuit of a receiver where the audio or video signal is separated from the carrier signal. Normally a rectifier, the output of which drives a lower frequency device.

DEVIATION RATIO

Ratio of the maximum frequency deviation to the maximum modulating frequency of a frequency modulation system, under specified conditions. (IEEE-72)

DF

Direction Finder.

DIFFERENTIAL PHASE SHIFT

A change in phase of a field quantity, at the output part of a network, produced by an adjustment of the electrical properties or characteristics of the network. *Note:* Differential phase shift may also be the difference between the insertion phase shifts of two 2-port networks. (IEEE-72)

DIFFERENTIAL-PHASE-SHIFT KEYING (Modulation)

A form of phase-shift keying in which the reference phase for a given keying interval is the phase of the signal during the preceding keying interval (See PHASE-SHIFT KEYING). (IEEE-72)

DIFFRACTION REGION

The space beyond the radio horizon which is shadowed from direct rays by (1) the curvature of the earth, (2) terrain irregularities or (3) objects.

DIGITAL

Composed of discrete numbers which represent all of the quantities that occur in a problem or calculation. The numbers, in turn, are represented by a system of codes composed of binary digits (either zero or one).

DIRECTIVE GAIN, Antenna (In a given direction)

4π times the ratio of the radiation intensity in that direction to the total power radiated by the antenna. *Note:* The directive gain is fully realized on reception only when the incident polarization is the same as the polarization of the antenna on transmission. (In EMC work, gain is commonly expressed in dB relative to an isotropic radiator, or dBi.) (IEEE-72)

DIRECTIVITY

The value of the directive gain in the direction of its maximum value. (IEEE-72)

DISCRIMINATOR

An electronic device which converts variations in frequency or phase to corresponding variations in amplitude.

DISTORTION

An undesired change in a waveform, usually the result of (1) a nonlinear relationship between input and output, (2) nonuniform transmission at different frequencies, or (3) a phase shift not proportional to frequency. (IEEE-72)

DISTRIBUTION, Normal (Gaussian)

The distribution of random variables found frequently in nature. The principal characteristics of the normal law are: (1) It is symmetrical. Negative and positive deviations of equal magnitude are equally likely to occur. (2) It is a continuous function rather than a discrete function. It assigns a definite probability to every finite deviation. There are no excluded cases. (3) There is just one probable result, and this is identical with the first expectation of the variable.

DIVERSITY

The provision of two or more choices of a given parameter so that an optimum signal can be selected from among the available choices. A system may employ space diversity, frequency diversity, polarization diversity, or any other arrangement by which a choice may be made among signals.

DOD

The Department of Defense.

DOPPLER EFFECT

The change in the observed frequency of a wave in a transmission system caused by a time rate of change in the effective path length between the source and the point of observation.

DOPPLER SHIFT

Magnitude, in hertz, of the change in observed frequency of a wave due to the Doppler effect. (IEEE-72)

DUCTING (Tropospheric)

Trapping of an electromagnetic wave, in a waveguide action, between two layers of the troposphere, or between a layer of the troposphere and the earth's surface.

DUPLEXER

A device which uses the finite delay between the transmission of a pulse and the receipt of an echo to permit the use of the same antenna for both transmitting and receiving. Commonly used in radars. (IEEE-72)

DUTY CYCLE

In a pulsed electronic device, the ratio of the average pulse duration to the average pulse spacing. This is numerically equivalent to the ratio of the average power to peak pulse power, and also to the product of the average pulse duration and the pulse repetition rate. Expressed either in percent or in dB.

DYNAMIC RANGE

The difference, in dB, between the overload level and the minimum acceptable signal level in a system. (The minimum acceptable signal level of a system is normally fixed by one or more of the following: noise level, low-level distortion, interference level, or resolution level.) (IEEE-72)

E

ECAC

The Department of Defense *Electromagnetic Compatibility Analysis Center*, Annapolis, Maryland.

ECCM

Electronic counter-countermeasures.

ECM

Electronic Countermeasures. Any of the various offensive or defensive tactics that use electronic and reflecting devices to reduce the effectiveness of enemy equipment or tactics that employ electromagnetic radiations.

EED

Electro-Explosive Device. Munitions designed to detonate as the result of the heat produced by an electric current in a wire.

EFFECTIVE APERTURE

A measure of the power extracted by an antenna from a passing electromagnetic wave. The effective aperture is defined as the ratio of the power in the antenna load resistance to the power density of the incident wave (See MAXIMUM EFFECTIVE APERTURE).

EFFECTIVE RADIATED POWER (ERP)

The power radiated by an antenna. Assuming a lossless transmission line, ERP is equal to transmitter power multiplied by antenna gain.

EFFECTIVE EARTH RADIUS

The value used in place of the geometric radius of the earth to correct for atmospheric refraction when the index of refraction in the atmosphere changes linearly with height.

(Note: Under conditions of standard refraction, the effective earth radius is 8.5×10^6 meters, or 4/3 the geometric radius.)

E-FILE

A data file that contains records of fixed base electronics equipment operated by the components of the Department of Defense, the FAA, and various other government agencies.

EIA

Electronic Industries Association.

ELECTROMAGNETIC COMPATIBILITY (EMC)

The ability of communications-electronics (C-E) equipment, sub-systems and systems to operate in their intended operational environments without suffering or causing unacceptable degradation because of unintentional electromagnetic radiation or response. EMC does not involve a separate branch of engineering but directs attention to improvement of electrical and electronic engineering knowledge and techniques to include all aspects of electromagnetic effects. (DoD Directive 3222.3)

EMC

Electromagnetic Compatibility.

EME

Electromagnetic Environment.

EMETF

Electromagnetic Environmental Test Facility (Part of USAEPG, Fort Huachuca, Arizona).

EMI

Electromagnetic Interference (See INTERFERENCE).

EMISSION SPECTRUM

The power or energy versus frequency distribution of a signal about its fundamental frequency. It includes the fundamental frequency and its associated modulation sidebands, harmonic and spurious emissions and their associated sidebands. (In EMC considerations, the out-of-band character of a given emission is often more significant than the amount of power in the near vicinity of the fundamental frequency.)

EMP

Electromagnetic Pulse.

EMPIRICAL

Derived from or guided by experimental observation.

EMV

Electromagnetic Vulnerability.

ENVELOPE (of a function)

A curve that is tangent to the peaks of the function. In amplitude modulation, the modulating frequency is the envelope of the carrier.

ENVIRONMENT, Electromagnetic

The signal and noise complex within which communications-electronics devices, including weapons systems, are operated.

ERP

Effective Radiated Power.

ERROR RATE

A measure of the quality of a digital circuit or equipment. The number of erroneous bits or characters in a sample, expressed in terms of errors per sample size.

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ESD

The Electronics Systems Division of the Air Force Systems Command.

ESSA

The former Environmental Science Services Administration. The functions of ESSA that relate to electromagnetic compatibility have been absorbed by the Office of Telecommunications, Department of Commerce.

EW

Electronic Warfare.

F

F (NOISE FIGURE)

See NOISE FIGURE.

FAA

The Federal Aviation Administration.

FADING

The variation of signal field intensity caused by changes in the transmission medium, and transmission path, with time. (IEEE-72)

FALL TIME

The time required for a pulse to decay from a maximum value to some stated fraction of the peak pulse amplitude.

FARADAY ROTATION

The process of rotation of the polarization ellipse of an electromagnetic wave in a magnetoionic medium. (IEEE-72)

FAR FIELD

The region of the field of an antenna where the angular field distribution is essentially independent of the distance from the antenna. If D (the maximum aperture dimension of the antenna) is large compared to the wavelength, λ , the inner boundary of the far field region is at a distance commonly taken to be $2D^2/\lambda$. *Note:* For an antenna focused at infinity, the far-field region is sometimes referred to as the Fraunhofer region on the basis of analogy to optical terminology. (IEEE-72)

FAST TIME CONSTANT

In radar, a circuit with short time constant used to emphasize signals of short duration and discriminate against the low frequency components of clutter. (IEEE-72)

FCC

The Federal Communications Commission.

FD

Frequency Diversity.

FDM

Frequency Division Multiplex. The process or device in which each modulating wave modulates a separate subcarrier and the subcarriers are spaced in frequency. *Note:* Frequency division permits the transmission of two or more signals over a common path by using different frequency bands for the transmission of the intelligence of each message signal. (IEEE-72)

FEED

1. To supply a signal to the input of a circuit.
2. The method by which transmitter power is supplied to an antenna (e.g., center-fed dipole, Cassegrain, horn).

FM

(See FREQUENCY MODULATION.)

FORTRAN

A coding system designed to facilitate the digital programming of engineering and mathematics problems. From "FORMula TRANslation".

FORWARD SCATTER

(See SCATTERING and SCATTER PROPAGATION.)

FOURIER TRANSFORM

A mathematical operation for transforming a signal described in time domain parameters to its associated spectrum in the frequency domain.

FRAUNHOFER REGION

(See FAR FIELD).

FREE SPACE

1. Empty space with no ions (no free electrons) present. It has the electrical constants of a vacuum. The electrical constants of air approximate those of a vacuum.
2. The condition where the radiation pattern of an antenna is not affected by surrounding objects such as earth, buildings, trees, etc.

FREE SPACE LOSS

The theoretical radiation loss which would occur in the transmission of electromagnetic energy if all variable factors except distance, d , were disregarded. The spherical spreading of radiated energy, defined by $ERP/4\pi d^2$.

FREQUENCY DEVIATION

In frequency modulation systems, the peak difference between the instantaneous frequency of the modulated wave and the carrier frequency. (IEEE-72)

FREQUENCY-DISTANCE SEPARATION

The combined isolation effect resulting from tuning two or more electronic devices, one of which is an emitter, at different frequencies and separating them physically. In general, to achieve a given performance level, their frequency difference must be increased as they are moved physically closer together.

FREQUENCY MODULATION

Angle modulation in which the instantaneous frequency of a sine-wave carrier is caused to depart from the carrier frequency by an amount proportional to the instantaneous value of the modulating wave. *Note:* Combinations of phase and frequency modulation are commonly referred to as frequency modulation. (IEEE-72)

FRUIT

Interference in a radar beacon system which results from other stations located in the same general area. Each interrogator receives and displays a reply synchronous to its own interrogation and many other replies, normally asynchronous, which appear as random dots (fruit). When the pulse repetition frequency of another interrogator is nearly identical, the fruit is synchronous and "false target" information is displayed.

FREQUENCY SHIFT KEYING (FSK)

The form of frequency modulation in which the modulating wave shifts the output frequency between predetermined values, and the output wave has no phase discontinuity. *Note:* Commonly, the instantaneous frequency is shifted between two discrete values termed the mark and space frequencies. (IEEE-72)

FREQUENCY STABILITY

The measure of the ability to remain on an assigned frequency.

FREQUENCY TOLERANCE (Radio Transmitter)

The extent to which a characteristic frequency of an emission, for example, the carrier frequency itself or a particular frequency in the sideband, may be permitted to depart from a specified reference frequency within the assigned band. *Note:* The frequency tolerance may be expressed in hertz or as a percentage of the reference frequency. (IEEE-72)

FTC

(See FAST TIME CONSTANT.)

FUNDAMENTAL FREQUENCY

1. The reciprocal of the period of a wave.
2. Mathematically, the lowest frequency component in the Fourier representation of a periodic quantity.
3. Normally, the assigned frequency of an electromagnetic emission. (IEEE-72)

G

GAIN

(See DIRECTIVE GAIN).

GAUSSIAN CURVE

A bell-shaped curve showing the distribution of probability associated with different values of a variate. It is given by $P(x) = \frac{e^{-x^2/2\sigma^2}}{\sigma \sqrt{2\pi}}$, where σ is the standard deviation. Synonymous with "normal distribution curve".

GIGAHERTZ (GHz)

A unit of frequency equal to 10^9 hertz.

GROUND CONSTANTS

The characteristics of the earth which affect surface propagation and ground reflection of an electromagnetic wave. Ground constants are *conductivity* (σ), normally expressed in mhos per meter, *relative permittivity* (ϵ_r) and *relative permeability* (μ_r), which are dimensionless.

GROUND PLANE

An extensive conducting surface connected to the earth, or to some conducting body which serves in place of the earth as a common reference for circuit returns and electrical or signal potentials.

GROUND WAVE

The total field, at a point within the radio horizon, produced by an elevated radiating antenna. It is composed of the direct wave, the ground-reflected wave, and the surface wave.

GUARD BAND

A band of frequencies, adjacent to the frequency of a desired signal, left vacant to provide a safety margin against mutual interference.

GUARD TIME

In time-division multiplexing, the time gap between the end of the time slot for one channel and the beginning of the time slot for the next channel. Guard time prevents overlap between adjacent time slots.

H

HALF DUPLEX

A circuit which permits communications between stations in only one direction at a time. Technical arrangements may permit operation in both directions, but not simultaneously. Therefore, this term is normally qualified by one of the following suffixes: S/O for send only; R/O for receive only; S/R for send or receive. (Synonymous with SIMPLEX.)

HARMONIC

A sinusoidal component of a periodic wave having a frequency that is an integral multiple of the fundamental frequency (e.g., harmonics of 60 hertz are 120 hertz, 180 hertz, 240 hertz, etc.). (IEEE-72)

HERO

An acronym for Hazards of Electromagnetic Radiation to Ordnance.

HERTZ (Hz)

Unit of frequency equal to one cycle per second.

HETERODYNE

The combining of two signal frequencies in a nonlinear device, with the result that frequencies equal to the sum and difference of the input frequencies are produced.

HF

High Frequency. In communications, the nominal HF band extends from 2 MHz to 30 MHz.

HIGH POWER EFFECTS (HPE)

Interference effects that occur in the presence of strong signals. High power effects are neither predictable nor preventable using the classical frequency-oriented methods of analysis (i.e., frequency assignment, intermodulation, spurious responses, etc.). The term includes both permanent electromagnetic damage and temporary performance degradation, and may or may not be dependent on the presence of an antenna.

HISTOGRAM

A graph of a distribution in which rectangles with bases on the horizontal axis are given widths equal to class intervals and heights equal to the number of units in each interval.

ICAO

International Civil Aviation Organization.

ICBM

Inter-Continental Ballistic Missile.

IF

Intermediate Frequency. The fixed frequency to which all carrier waves are converted, resulting from the combination of the received signal and a local oscillator signal, in a superheterodyne receiver.

IFF

Identification, Friend or Foe. A method used both with and without radar for the automatic identification of an aircraft or ship. A coded interrogation signal received by a correctly adjusted receiver causes the automatic transmission of an identification signal, usually on another frequency.

ILS

Instrument Landing System.

ILLUMINATION, Aperture

(See APERTURE ILLUMINATION.)

IMAGE FREQUENCY

In heterodyne frequency converters in which one of two sidebands produced by beating is selected, the image frequency is an undesired input frequency capable of producing the selected frequency by the same process. *Note:* The word "image" implies the mirror-like symmetry of signal and image frequencies about the beating oscillator frequency or the intermediate frequency, whichever is the higher. (IEEE-72)

IMAGE REJECTION

The decrease in response of a superheterodyne receiver to the image frequency as compared with its response to the desired signal, usually expressed in decibels.

IN BAND

Signals at frequencies within the IF pass band of a receiver.

INTERFERENCE

Electromagnetic phenomena which, either directly or indirectly, contribute to degradation in the performance of an electronic receiver or system. *Note:* Interference can be produced by both natural and man-made sources either external or internal to the signal transmission system.

INR (INTERFERENCE-TO-NOISE RATIO)

The ratio of the amount of interfering signal power at the input to the final detector of a receiver, to the amount of noise power produced by that receiver, usually expressed in decibels.

INTERMODULATION

The mixing of two or more RF signals in a nonlinear element to produce signals at new frequencies which are sums and differences of the input signals or their harmonics. The nonlinear element may be the output stage of a transmitter, the input circuits of a receiver, or some external device.

INTEROPERABILITY

The ability of two or more communications systems, even though designed for different purposes, to interface completely with each other as part of the same system, if necessary. *Note:* The term implies identical signal formats, frequency ranges, data rates, etc., but not necessarily the same power, antenna type, or physical dimensions. An example of interoperability would be a small, low powered, tactical equipment with the ability to access a high powered strategic communications system, if desired.

IONOSPHERE

That part of the earth's outer atmosphere where free ions and free electrons are normally present in quantities sufficient to affect the propagation of radio waves. The altitude of the ionosphere is between approximately 80 km and 400 km. (IEEE-72)

IRAC

Interdepartment Radio Advisory Committee. A U.S. Government body established for the control of the radio frequency spectrum.

IRBM

Intermediate Range Ballistic Missile.

IRIG

Inter-Range Instrumentation Group.

ISOLATION

In electronics, the opposite of coupling. The degree to which energy transfer between two units or systems is prevented.

ISOTROPIC ANTENNA

A hypothetical antenna that radiates or receives energy of all polarizations equally well in all directions. An isotropic antenna is a lossless point source used as the theoretical reference in describing the absolute gain of a real antenna.

ITU

The International Telecommunications Union.

J

J-12

A permanent working group, under the U.S. Joint Frequency Panel, established to process Department of Defense applications for frequency allocations.

JAMMING

Deliberate radiation, reradiation or reflection of electromagnetic signals with the object of impairing the use of electronic devices by an enemy.

JAMMING-TO-SIGNAL RATIO (J/S)

The ratio of the magnitude of a jamming signal to that of a desired signal at a given point such as the antenna terminals of a receiver. Usually expressed in decibels.

JCS (J-6)

The communications-electronics section of the Joint Chiefs of Staff organization. The Military Head of JCS (J-6) is one member of a two-member board of directors for the Department of Defense Electromagnetic Compatibility Program. [See ASD(T).]

JFP

The Joint Frequency Panel of the U.S. Military Communications-Electronics Board. Created to control the allocation and assignment of frequencies within the Department of Defense and among the Unified and Specified Commands of the U.S. Military Establishment.

JITTER

The short-term instability of a signal. The instability may be in amplitude, phase, frequency or repetition rate (for pulsed signals), and may be accidental or deliberate. The term "tracking jitter" is used to describe minor variations in the pointing of an automatic tracking radar.

JTAC

The Joint Technical Advisory Committee of the Institute of Electrical and Electronic Engineers (IEEE) and the Electronics Industries Association (EIA).

K

KILL

Prevention, through active means, of the successful accomplishment of the mission of an enemy target. A kill normally involves destruction.

KILL PROBABILITY

The likelihood of producing a kill under the conditions specified. The chance that a target will be destroyed by a given operation.

KILOHERTZ (kHz)

A unit of frequency equal to 1000 hertz.

KLYSTRON

Electron tube in which the electrons are periodically bunched by electric fields. The resulting velocity-modulated electron beam is fed into a cavity resonator to sustain oscillations within the cavity at a desired microwave frequency.

KNIFE EDGE

A terrain irregularity, such as a mountain ridge, that is sharp enough and high enough to reduce and refract the propagation of a direct electromagnetic wave.

L

LF

Low Frequency. The Low Frequency band encompasses signals between 30 kHz and 300 kHz.

LIMITER

A device in which some characteristic of the output is automatically prevented from exceeding a predetermined value. More specifically, a circuit in which the output amplitude is substantially linear with regard to the input up to a predetermined value and substantially constant thereafter. (IEEE-72)

LINEAR

Having an output which varies in direct proportion to the input.

LINEAR ARRAY

An antenna arrangement in which the elements are arranged along a straight line. The elements may or may not be equally spaced.

LOBE

One of the three-dimensional portions of the radiation pattern of an antenna. A lobe is bounded by radiation minima or nulls and is normally treated as having the value of the peak radiation intensity within it.

LOCK ON

The condition in which a tracking or target-seeking system is continuously and automatically tracking a target.

LOS

Line-of-Sight.

M

MAGNETRON

A vacuum tube in which electrons, controlled by crossed steady electric and magnetic fields, interact with the field of a circuit element to produce an alternating-current power output. (IEEE-72)

MAIN BEAM

The lobe radiated in the boresight direction from a directive antenna.

MATHEMATICAL MODEL

A set of equations used to represent a physical system, process, device, or concept. (IEEE-72)

MATRIX

1. In mathematics, an array of quantities in a prescribed form, usually capable of being manipulated by means of a mathematical operator or another matrix according to prescribed rules.
2. A computer logical network consisting of a rectangular array of intersections of input-output leads with diodes, magnetic cores, relays, or other circuit elements connected at some of these intersections. Such a matrix can be used to store information or to function as a coder or decoder.
3. The section of a color television receiver that transforms the color-difference signals from the transmitter into the red, yellow, and blue signals needed to drive the color picture tube.

MAXIMUM EFFECTIVE APERTURE

With respect to any antenna, the ratio of the square of the incident voltage to four times the product of the incident power density and antenna radiation resistance.

MCEB

Military Communications-Electronics Board.

MDS

Minimum Discernible Signal. The receiver input power level that is just sufficient to produce a discernible output from the receiver.

MEACONING

A system for receiving beacon signals and rebroadcasting them on the same frequency to confuse navigation. Meaconing causes inaccurate indications of range and/or bearing in aircraft and ground interrogators.

MEGAHERTZ (MHz)

A unit of frequency equal to one million (10^6) hertz.

MICROSECOND

10^{-6} seconds.

MITIGATION

A lessening of the effects (of interference); making (them) less severe; moderating.

MIXER

1. A circuit having two or more input signals and an output signal that is some desired function of the input. (IEEE-72)
2. A stage in a heterodyne receiver where the incoming signal is beat with a signal from a local oscillator to produce an intermediate frequency (IF) signal.

MLS

Microwave Landing System.

MODEM

Acronym for modulator-demodulator.

MODULATION

1. The process, or the result of the process, by which a characteristic of one wave is varied according to some characteristic of another wave.
2. The process of adding information to a carrier.

MODULATION, Amplitude (AM)

Modulation in which the amplitude of a carrier is varied at a rate corresponding to the frequency of the intelligence carried.

MODULATION, Frequency (FM)

Angle modulation of a sine-wave carrier in which the instantaneous frequency of the modulated wave differs from the basic carrier frequency by an amount proportional to the instantaneous value of the modulating wave.

MODULATION, Phase (PM)

Angle modulation in which the instantaneous phase angle of the modulated wave differs from the phase of the original sine-wave carrier by an amount proportional to the instantaneous value of the modulating wave. (*Note:* Combinations of phase and frequency modulation are commonly referred to as frequency modulation.)

MODULATION, Pulse

1. Modulation of a carrier by a pulse train. (In this sense, the term is used to describe the process of generating carrier-frequency pulses.)
2. Modulation of one or more characteristics of a pulsed carrier. (In this sense, the term is used to describe methods of changing pulse characteristics so that information may be carried by a pulsed carrier.)

MODULATION FACTOR

In an amplitude-modulated wave, the ratio (usually expressed in percent) of the peak variation of the envelope from its reference value, to the reference value. (IEEE-72)

MODULATION INDEX

In frequency modulation with a sinusoidal modulating wave, the ratio of the frequency deviation of the modulated wave to the frequency of the modulating function. (IEEE-72)

MODULE

A combination of components that provides at least one complete function necessary for sub-system or system operation, so arranged that the components are common to one mounting.

MOVING TARGET INDICATOR (MTI)

A device, based on the doppler principle, that limits the display of radar information primarily to moving targets.

MUF

Maximum Usable Frequency. The frequency that has a 50% probability of attaining ionospheric reflection support over a specified skywave path throughout the month at the same time each day.

MULTICOUPLER

A device for connecting several receivers or transmitters to one antenna in such a way that the equipment impedances are properly matched to the antenna impedance.

MUTUAL INTERFERENCE

The condition resulting when electronic systems degrade each other on a reciprocal basis.

N

NANOSECOND

10^{-9} seconds.

NAUTICAL MILE

The distance equal to a great circle arc of one minute on the earth's surface. A close and convenient approximation is 2000 yards.

NAVAIDS

Navigation Aids.

NAVELEX (NESC)

The Naval Electronics Systems Command.

NAVORD (NOSC)

The Naval Ordnance Systems Command.

NAVSEC

The Naval Ship Engineering Center.

NAVSHIPS (NSSC)

The Naval Ships Systems Command.

NEAR FIELD (of an antenna)

The region of the field of an antenna within the distance $2D^2/\lambda$ from the antenna face, where D is the maximum aperture dimension and λ is the wavelength of the radiated energy. The near field is normally thought of as consisting of two zones: (1) a reactive zone immediately surrounding the antenna wherein the reactive field predominates and the field distribution is largely independent of distance from the antenna, and (2) a radiating zone, between the reactive zone and the far field, wherein the angular field distribution is

dependent on the distance from the antenna. The boundary between the two zones occurs at the distance $\lambda/2\pi$ from the antenna surface. (Synonymous with FRESNEL REGION.)

NELC

The Naval Electronics Laboratory Center, San Diego, California.

NOISE

1. Unintelligible signals in an electrical, electronic or electromechanical system which tend to interfere with proper perception or interpretation of the desired signals.
2. Random unwanted energy.

NOISE FIGURE (FACTOR)

The ratio of the noise power in the output of an amplifier to that part of the output noise power that is due solely to the noise in the input signal. Noise Figure is a measure of the noisiness of an amplifier relative to the noisiness of the input signal source.

NOMOGRAM

A graph containing several scales graduated for different variables so that, when a straight line connects values of any two, the related values of the others may be read directly at the points intersected by the straight line.

NONLINEAR EFFECTS

Phenomena resulting from the mixing of two or more signals in a device whose output is neither directly nor inversely proportional to the input. (See INTERMODULATION.)

NULL

1. Point of minimum or zero indication. Usually an indication that the quantity being measured has been balanced by an opposing quantity.
2. In an antenna pattern, the point of minimum radiation (or reception) between lobes.

NUTATING FEED

An arrangement in which the feed of an antenna (such as a dipole feeding a parabolic reflector) is mechanically rotated off axis in such a manner as to produce either a spiral or conical beam pattern.

NWL

The U.S. Naval Weapons Laboratory, Dahlgren, Virginia.

O

OASD(T)

The Office of the Assistant Secretary of Defense for Telecommunications.

OCCUPIED BANDWIDTH

(See BANDWIDTH, Occupied.)

OCTAVE

The interval between two frequencies having a ratio of 2:1. (IEEE-72)

OFF FREQUENCY REJECTION (OFR)

In a receiver, the amount of attenuation to a signal at a frequency other than the tuned frequency as a result of the selectivity characteristic of the receiver and the power-versus-frequency characteristic of the signal.

ORDER OF THE PRODUCT

In intermodulation, the integer which is the sum of the coefficients of the terms in an equation expressing the frequency relationships involved (e.g., in the equation $f_{IM} = 3f_a - 2f_b$, the result is a fifth order product).

OT

The Office of Telecommunications, U.S. Department of Commerce.

OTH

Over the Horizon.

OTP

Office of Telecommunications Policy (Executive Office of the President).

OUT-OF-BAND

Signals at frequencies outside of the IF pass band of a receiver.

P

PARAMETER

1. (Mathematical) A coefficient that is given a constant value for a specific purpose or process.
2. (Physical) One of the coefficients entering into a functional equation and corresponding to some characteristic property, dimension, or degree of freedom.

PARAMETRIC AMPLIFIER

An inverting parametric device used to amplify a signal without frequency translation from input to output. (IEEE-72)

PARAMETRIC DEVICE

A device whose operation depends essentially upon the time variation of a characteristic parameter, usually reactance.

PASS BAND

In a receiver or a filter, the difference between the lower and upper frequencies at which a given fraction (usually half) of the maximum output is obtained.

PATH LOSS

The power attenuation of a signal over the path between a transmitting antenna and a receiving antenna, due to all causes.

PCM

Pulse Code Modulation.

PEAK POWER

1. In a modulated carrier system, the power, averaged over a carrier cycle, at the maximum amplitude that can occur with any combination of signals to be transmitted. (IEEE-72)

2. In a pulse radar system, the maximum value of the transmitted pulse.

PHASED ARRAY ANTENNA

An array antenna whose beam direction or radiation pattern is controlled primarily by the relative phases of the excitation coefficients of the radiating elements. (IEEE-72)

PHASE SHIFT KEYING (PSK)

The form of phase modulation in which the modulating function shifts the instantaneous phase of the modulated wave between predetermined discrete values. (IEEE-72)

PM

Phase Modulation.

PMR

The Pacific Missile Range.

POLARIZATION

1. That property of a radiated electromagnetic wave describing the time-varying direction and amplitude of the electric field vector; specifically, the figure traced as a function of time by the extremity of the vector at a fixed distance in space, as observed along the direction of propagation. (IEEE-72)
2. The orientation of molecular magnets in a piece of iron or other magnetic material in a magnetic field, whereby the tiny internal magnets tend to align themselves with the magnetic lines of force.
3. The effect produced in a dielectric, when it is placed in an electric field, whereby the negative charge in each atom is slightly displaced with reference to the positive charge.

POST DETECTION

That portion of a receiver's circuitry which, with respect to a signal being processed, is chronologically after the detector. Post detection signals are at audio or video frequencies, having been removed from the carrier by the detection process.

POWER DENSITY (SPATIAL)

The net power in a given cross sectional area of a propagating medium. Convenient units are watts (or dBm) per square meter. Spatial power density is independent of frequency.

POWER LEVEL

The magnitude of power averaged over a specified interval of time. Power level may be expressed in units in which the power itself is measured, or in decibels indicating the ratio with respect to a reference power level (e.g., dBm is the number of decibels referenced to one milliwatt).

PPI

Plan Position Indicator, a type of radar display in which the information is presented in polar coordinates, with the radar usually located in the center of the oscilloscope.

PREDETECTION

That portion of a receiver's circuitry which, with respect to the signal being processed, is chronologically prior to the detector. Predetection signals contain the carrier signal and all modulation, and are basically at radio frequencies.

PREDICTION MODEL

An analytical representation of a physical phenomenon for the purpose of predicting behavior under stated conditions (e.g., the construction of an emission spectrum from the parameters of a time waveform, or the calculation of possible intermodulation products for a planned frequency assignment).

PRF

Pulse Repetition Frequency. The number of pulses per unit of time, usually expressed in pulses per second (pps).

PROPAGATION ANOMALY

A change in propagation characteristics due to a discontinuity or abnormality in the medium of propagation.

PROPAGATION LOSS

The attenuation of signals passing between two points in a transmission path.

PROPAGATION PATH

The route by which a signal, or a portion of a signal, travels from transmitting antenna to receiving antenna. Possible paths include the direct path, reflected path, skywave path, refracted path, etc.

PSK

(See PHASE SHIFT KEYING.)

PULSE COMPRESSION

Any technique for modifying or processing a pulse so that the autocorrelation function is greater than one. Pulse compression generally results in increased range resolution and enhancement of the desired signal, even in the presence of interference.

PULSE MODULATION

(See MODULATION, Pulse.)

PULSEWIDTH (PW)

The time interval between the first and last instants at which the instantaneous amplitude is greater than a stated fraction (usually half) of the peak pulse amplitude.

pW

Picowatt. 10^{-12} watts (−90 dBm).

pWp

Picowatts, psophometrically weighted. (Psophometric — from the Greek psophos, meaning noise. Psophometric weighting is related to the interference effect of a 3-kHz band of white noise with a power of −88 dBm.)

Q

QRC

Quick Reaction Capability.

QUALITY FACTOR (Q)

The quality factor of a component or circuit. For both parallel and series tuned circuits, Q is approximately equivalent to the ratio of the resonant frequency to the bandwidth between the 3 dB points.

QUIETING

In an FM receiver, the phenomenon which results in less noise when an unmodulated carrier is present than when there is no carrier present.

R

RADC

Rome Air Development Center, located at Griffiss Air Force Base, Rome, N.Y.

RADHAZ

An acronym for RADiation HAZard.

RADIATION RESISTANCE (antenna)

The ratio of the power radiated by an antenna to the square of the root-mean-square antenna current referred to a specified point. (IEEE-72)

RADIO FREQUENCY (RF)

1. (Loosely) A frequency in the portion of the electromagnetic spectrum that is between the audio portion and the infrared portion.
2. A frequency useful for radio transmission (roughly between 10 kHz and 100 GHz). (IEEE-72)

RADIO HORIZON

The locus of all points at which direct rays from an antenna are tangent to the earth's surface.

RANDOM ACCESS

In a computer, the process of gaining access to storage where the time required for such access is independent of the location of the information most recently obtained or placed in storage.

RANDOM-ACCESS, DISCRETE ADDRESS (RADA)

A communications technique in which radio users share one wide frequency band instead of each user getting a narrow band for himself.

RAYLEIGH DISTRIBUTION

The frequency distribution for an infinitely large number of quantities of the same magnitude, but of random phase relationships. Sky wave field intensities follow the Rayleigh distribution for one minute or smaller time intervals.

RECEIVER NOISE

Noises produced within a receiver, consisting of four types, namely (1) thermal agitation, (2) shot effect, (3) microphonics and (4) hum from the a-c power source, if present.

RECEIVER NOISE FIGURE

Receiver noise figure can be described as a measure of signal-to-noise ratio degradation as the signal passes through the receiver.

$$\begin{aligned}
 F_n &= \frac{S_i/N_i}{S_o/N_o} = \frac{S_i N_o}{S_o N_i} = \frac{G S_i (N_i + N_R)}{G S_i N_i} \\
 &= 1 + \frac{N_R}{k TB}
 \end{aligned}$$

where

- F_n = Receiver noise figure
- S_i = Input signal level, watts
- N_i = Input noise level = kTB (watts)
- k = Boltzmann's Constant, 1.38×10^{-23} Joules/ K°
- T = absolute Kelvin temperature
- B = the effective receiver bandwidth, Hz
- S_o = Output signal level, watts

N_o = Output noise level, watts

N_R = Receiver noise, watts

G = Receiver gain

Logarithmically,

$$F_n \text{ (dBm)} = -174 + 10 \log (1 + N_R) - 10 \log B_n$$

RFI

Radio Frequency Interference. Synonymous with electromagnetic interference. (See INTERFERENCE.)

RISE TIME

The time interval between the instants at which the instantaneous pulse amplitude first reaches specified lower and upper limits (normally taken to be 10 percent and 90 percent of the peak pulse amplitude).

ROOT-MEAN-SQUARE (RMS)

The square root of the average of the squares of the values of a periodic quantity, taken throughout one complete period. Thus, if y is a function of t

$$Y_{rms} = \left[\frac{1}{T} \int_a^{a+T} y^2 dt \right]^{1/2}$$

where Y_{rms} is the root-mean-square value of y , a is any value of time, and T is the period.
(IEEE-72)

S

SAE

Society of Automotive Engineers.

SAM

Surface-to-Air Missile.

SATURATION

1. The condition which exists in a circuit when an increase in the actuating (input) component produces no further increase in the resultant effect (output).
2. The condition in electron tubes under which maximum current is passing through the cathode circuit.
3. The maximum possible density of a magnetic field.

SCATTERING

The production of waves of changed direction, frequency, or polarization when radio waves encounter matter. *Note:* The term is frequently used in a narrower sense, implying a disordered change in the incident energy. (IEEE-72)

SCATTER PROPAGATION

Transmission of HF, VHF, UHF, and SHF radio waves beyond line of sight distances over tropospheric and ionospheric paths.

SCSE

Smooth Curve-Smooth Earth. A type of propagation model for conditions as described.

SELECTIVITY

1. The characteristic which determines the extent to which it is possible to differentiate between the desired signal and signals at other frequencies.
2. The degree to which a radio receiver can accept the signals of one station while rejecting those of other stations on nearby channels (usually expressed as a curve in which the input signal voltage required to produce a constant power output is plotted against frequency).

SENSITIVITY (Receiver)

The minimum input signal required to produce an output signal having a specified signal-to-noise ratio. The lower limit of useful input signal power.

SENSITIVITY-TIME CONTROL (STC)

The portion of a system that varies the amplification of a radio receiver in a predetermined manner as a function of time. *Note:* STC is frequently used to reduce the clutter in the center of a radar PPI scope. (IEEE-72)

SIDEBANDS

1. The frequency bands on both sides of the carrier frequency within which fall the frequencies of the wave produced by the process of modulation.

2. The wave components lying within such bands. *Note:* In the process of amplitude modulation with a sine-wave carrier, the upper sideband includes the sum (carrier plus modulating) frequencies; the lower sideband includes the difference (carrier minus modulation) frequencies. (IEEE-72)

SIDELobe

A portion of the energy from a directional antenna, radiated in a direction other than the boresight axis.

SIGNAL-TO-NOISE RATIO (SNR) (S/N)

The ratio of the magnitude of a specified signal to that of the noise in the circuit, most often expressed in decibels. *Note:* Noise includes antenna-borne components as well as internally generated effects such as thermal noise, shot noise, power supply hum and microphonics.

SIMPLEX OPERATION

Method of radio operation in which communications between stations takes place in only one direction at a time. *Note:* This includes ordinary transmit-receive operation, press-to-talk operation, voice-operated carrier and other forms of manual or automatic switching from transmit to receive. (Sometimes called HALF DUPLEX.) (IEEE-72)

SINGLE SIDEBAND (SSB) TRANSMISSION

A method of communication in which the frequencies produced by the process of modulation on one side of the carrier are transmitted and those on the other side are suppressed. The carrier frequency may be either transmitted or suppressed.

SKYWAVE

A radio wave propagated by way of the ionosphere.

SONOBUOY

An instrument designed to receive sound energy underwater and transmit a corresponding signal in the atmosphere at radio frequencies.

SPECTRAL POWER DENSITY

The power density per unit bandwidth.

(IEEE-72)

SPECTRUM SIGNATURE

The power versus frequency distribution of the energy in a transmitted signal, or the response characteristic of a receiver. A full spectrum signature includes the fundamental frequency, the associated modulation sidebands, harmonics and their associated sidebands, and spurious emissions (spurious responses in the case of a receiver).

SPURIOUS EMISSION

A radiation from a transmitter at a frequency outside of its assigned or intended emission frequency band. Spurious emissions include harmonic emissions, parasitic emissions, and intermodulation products, but exclude emissions in the immediate vicinity of the assigned frequency which are the result of the modulation process and necessary for the transmission of information.

SPURIOUS RESPONSE

Any response of an electronic receiver or device to signals at frequencies other than the frequency to which it is tuned.

STANDARD BROADCAST BAND

The band of frequencies extending from 540 to 1600 kHz.

STANDARD DEVIATION

In statistics, a measure of the dispersion in a frequency distribution, equal to the square root of the mean of the squares of the deviations from the arithmetic mean of the distribution.

STC

(See SENSITIVITY-TIME CONTROL.)

STOCHASTIC

Statistics. Of or pertaining to a process involving a randomly determined sequence of observations, each of which is considered as a sample of one element from a probability distribution. Stochastic variation implies randomness, as opposed to a fixed rule or relation, in passing from one observation to the next in order.

SUBHARMONIC

A sinusoidal quantity having a frequency which is an integral sub-multiple of the frequency of some other sinusoidal quantity to which it is referred. (IEEE-72)

SUPPRESSION

Elimination or reduction of any component of an emission, as a particular frequency or group of frequencies, in an audio or radio-frequency signal.

SURFACE WAVE

The component of the ground wave which travels along the surface of the earth.

SUSCEPTIBILITY

The response of an equipment to an undesired signal relative to the response of the same equipment, under the same conditions, to a desired signal.

SUSCEPTIBILITY THRESHOLD

The amount of signal power required at the input terminals of a receiver to cause barely perceptible interference at the receiver output terminals.

T

TACAN

A complete ultra-high-frequency polar coordinate (rho-theta) navigation system using pulse techniques; the distance (rho) function operates as distance-measuring equipment (DME) and the bearing function is derived by rotating the ground transponder antenna so as to obtain a rotating multilobe pattern for coarse and fine bearing information. (IEEE-72)

TDM

Time Division Multiplexing. The process of transmitting two or more channels of information over a single link by allocating a different time interval for the transmission of each channel.

TELEMETRY

The science of making measurements at a remote location and reproducing the measurements in real time at a convenient location.

THERMAL NOISE (circuit)

Random noise associated with the thermodynamic interchange of energy necessary to maintain thermal equilibrium between the circuit and its surroundings. *Note:* Thermal noise power is proportional to the bandwidth of the device and to the absolute temperature in degrees Kelvin. (IEEE-72)

TIME SHARING

With respect to EMC, time sharing is the use of a single frequency for two or more purposes by allotting a portion of the available transmission time to each purpose.

TRANSDUCER

A device which, when activated by input energy from one system, supplies related output energy into another system.

TRANSFER FUNCTION

A mathematical, graphic, or tabular statement of the influence that a system or element has on a signal or action compared at input and at output terminals. (IEEE-72)

TRANSIENT

1. Instantaneous surge of voltage or current which occurs as the result of a change from one steady-state condition to another.
2. Damped oscillatory quantity occurring in the output of a system as a result of a sudden change in input.

TRAVELING WAVE TUBE (TWT)

Electron tube in which a beam of electrons interacts continuously with the electric field of an electromagnetic wave traveling in a helix to produce amplification at ultra-high frequencies and above.

TROPOSPHERIC SCATTER

Propagation of radio waves by scattering as a result of irregularities or discontinuities in the physical properties of the troposphere.

TUNNEL DIODE

A junction transistor that has negative resistance in the forward direction over a portion of its operating range.

U

ULTRA-HIGH FREQUENCY (UHF)

1. A frequency between 300 MHz and 3 GHz.
2. The 225-400 MHz band has been allocated for military communications use. Because of the plethora of equipment in this band, it is commonly, albeit incorrectly, referred to as the "UHF band".

UNDESIRED SIGNAL

1. Any signal which tends to produce degradation in the operation of an electronic device.
2. Interference.

USAECOM

U.S. Army Electronics Command, Fort Monmouth, NJ.

USAEPG

U.S. Army Electronic Proving Ground, Fort Huachuca, AZ.

USAMC

U.S. Army Material Command.

USAMICOM

U.S. Army Missile Command, Huntsville, AL.

USARADCOM

U.S. Army Air Defense Command, Colorado Springs, CO.

USASTRATCOM

U.S. Army Strategic Communications Command, Fort Huachuca, AZ.

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USATECOM

U.S. Army Test and Evaluation Command, Aberdeen Proving Ground, MD.

UTM

Universal Transverse Mercator. A grid system based on a Mercator projection of the earth's surface.

V

VALIDATION

1. Proving, usually experimentally, the correctness of a prediction or a prediction model.
2. Confirmation of a theoretical principle.

VAN ALLEN BELT

Either of two regions of high-energy charged particles surrounding the earth; the inner region is centered at an altitude of 2,000 miles and the outer region is at an altitude between 9,000 and 12,000 miles.

VARACTOR

A two-terminal semi-conductor device in which the electrical characteristic of primary interest is a voltage-dependent capacitance. (IEEE-72)

VELOCITY MODULATION

Modification of the velocity of an electron stream by alternately accelerating and decelerating the electrons with a period comparable with the transit time in the space concerned. A Klystron tube employs velocity modulation.

VERTICAL POLARIZATION

An electromagnetic emission is vertically polarized when its electric field (E vector) is perpendicular to the plane of the earth.

VERY HIGH FREQUENCY (VHF)

Frequencies between 30 and 300 MHz, with wavelengths between 1 and 10 meters.

VERY LOW FREQUENCY (VLF)

Frequencies between 3 and 30 kHz with wavelengths greater than 10,000 meters.

VOICE CODER (VOCODER)

A device which converts speech input into coded form (usually digital) for secure transmission. A decoder converts the digital signals back to speech at the receiver.

VOLTAGE STANDING WAVE RATIO (VSWR) (Waveguide)

The ratio of the magnitude of the transverse electric field in a plane of maximum strength to the magnitude at the equivalent point in an adjacent plane of minimum field strength.

VOR

Very-high-frequency omnidirectional radio range. A specific type of range - - - providing radial lines of position in any direction as determined by bearing selection within the receiving equipment; it emits a (varying) modulation whose phase relative to a reference modulation is different for each bearing of the receiving point from the station. (IEEE-72)

VORTAC

A designation applied to certain navigation stations (primarily in the United States) in which both VOR and TACAN are used; the distance function in TACAN is used with VOR to provide bearing and distance (VOR/DME) (rho theta) navigation. (IEEE-72)

W

WAVEGUIDE CUT OFF

(See CUT OFF FREQUENCY.)

WHIP ANTENNA

A flexible vertical rod antenna, usually between one-tenth and one-half wavelength long, supported on a base insulator.

WHITE NOISE

Noise, either random or impulsive, that has a flat frequency spectrum over a wide total frequency band.

WINDOW

A clear space in the frequency spectrum.

WORD

1. An ordered set of characters, normally digital, which is the unit in which information is stored, transmitted, or operated on within a computer.
2. A group of bits which occupies one storage address and is treated by the computer as a unit.

WSMR

White Sands Missile Range.

X Y Z

YIG DEVICES

Small, solid-state filters, discriminators, and multiplexers using yttrium-iron garnet (YIG) crystals in combination with a variable magnetic field to achieve wideband tuning in microwave circuits.

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LINK B

LINK C

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WT

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WT

ROLE

WT

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